REMARKS

This paper is responsive to the Final Office Action dated August 30, 2010 wherein claims 12-30 were rejected. Claim 29 is amended. Also, claims 21, 26 and 30 are amended to correct minor informalities. No new matter is added. Claims 12-30 remain pending in this application. In view of the following amendment and remarks, Applicants request further examination and reconsideration of the present patent application.

REJECTIONS 35 U.S.C. §101

The Examiner rejected claim 29 under 35 U.S.C. §101 because the claimed invention is directed to non-statutory subject matter. The Examiner noted that while claim 29 defines a "computer readable medium" embodying functional descriptive material, it does not define a non-transitory computer-readable medium or memory and is thus non-statutory for that reason. Furthermore, the Examiner suggested amending claim 29 to embody the program on a "non-transitory computer readable medium" to the claim or equivalent in order to make the claim statutory. Applicants hereby amend claim 29 to include the recitation of "non-transitory" in the claim. No new matter is added.

In light of this amendment, Applicants believe that the Examiner's rejection of claim 29 is overcome. Accordingly, Applicants respectfully request the Examiner to withdraw the rejection of claim 29 under 35 U.S.C. §101.

REJECTIONS UNDER 35 U.S.C. §103

In the Office Action, the Examiner rejected claims 12-30 under 35 U.S.C. §103(a) as being unpatentable over Shih et al., U.S. Patent Application No. 2005/0152504 (hereinafter "Shih") in view of Liang et al., U.S. Patent No. 7,187,794 (hereinafter "Liang"). Applicants respectfully traverse the rejection of the claims.

Claims 12, 21, 28, 29 and 30 are independent. All of the recited claims are believed to be patentable for at least the reasons stated below.

Obviousness cannot be established absent a teaching or suggestion in the prior art to produce the claimed invention. For a *prima facie* case of obviousness, the Examiner must set forth the differences in the claim over the applied references, set forth the proposed modification of the references, which would be necessary to arrive at the claimed subject matter, and explain why the proposed modification would be obvious. It is well-established law that the mere fact that references may be combined or modified does not render the resultant modification or combination obvious unless the prior art suggests the desirability of the modification or combination.

Claims 12, 21, 28, 29 and 30 and the Claims Depending Therefrom.

A. Shih even in combination with Liang fails to disclose features recited by independent claims 12, 21, 28, 29 and 30.

Applicants submit that independent claims 12, 21, 28, 29 and 30 recite, in generally similar language, *methods and systems for generating a variance map from measured projection data acquired from a tomography system.* Particularly, measured projection data is accessed from the tomography system, *a variance measure is formulated based upon the measured projection data* and *the variance map is generated from the variance measure using a reconstruction algorithm.*

In the Office Action, the Examiner argued that Shih teaches a method for generating a variance map from measured projection data acquired from a tomography system comprising: accessing the measure projection data from the tomography system (citing A tomography system 100 comprises an imaging system 102 and noting that FIG. 3 of Shih teaches acquiring an object projection of an object 310); formulating a variance measure based upon the measured projection data (citing paragraph [0010] of Shih, generating the variance reconstruction from the variance projections) and generating a variance map from the variance measure using a reconstruction algorithm (citing paragraph [0043] of Shih, the variance projection includes an intensity map and positional data for the perspective that is common to the standard and object projections, and noting that 3D variance reconstruction of the variations between the object and the standard is generated, and the object is qualified based on the variance reconstruction). Applicants respectfully disagree.

Applicants submit that the present application is drawn to methods and systems for generating a variance map from measured projection data acquired from a tomography system. Particularly, as disclosed in the present application, measured projection data is acquired using a tomography system and stored (see steps 90 and 92 of FIG. 6). This measured projection data is then accessed for processing to facilitate identification of variances in the pixel data (see step 96 of FIG. 6). More specifically, *the measured projection data is processed to generate variance data and a variance map from the measured projection data*. As clearly evidenced by the present application (for example, see FIGs. 6-7 and passages at least at paragraphs [0037] and [0040]), *a variance measure is formulated based upon the measured projection data*. Particularly, the variance measure is formulated by replacing the measured projection data by an estimate of the signal variance (see step 102 of FIG. 7). By way of example, in the case of X-ray CT, the estimate of the signal variance is determined by assuming that the measured projection data are Poisson random variables.

Furthermore, a standard deviation measure is formulated based upon the measured projection data using a statistical model (see step 104 of FIG. 7). Moreover, other sources of noise or measures of uncertainty due to other physical effects may be modeled and calculated from the measured projection data (see step 106 of FIG. 7). Also, the variance measure is computed from the standard deviation measured (see step 108 of FIG. 7). Processing the measured projection data as described hereinabove aids in establishing a statistical relationship and statistical model between the measured projection data and the estimate of the variance measure associated with the measured projection data.

Subsequently, a weighted filtered backprojection reconstruction algorithm is used to operate on the variance data to generate the variance map (see step 110 of FIG. 7). Particularly, as evidenced by steps 112-116 of FIG. 8 of the present application, the generation of the variance map includes applying squared weights to the variance measure, applying squared impulse responses to the variance measure and applying backprojection to the variance measure. Consequent to this processing, a variance map that includes pixel variances is generated. It may be noted that this variance map tends to be smoother than the original image data, and hence allows use of fast algorithms for backprojection and/or reconstruction with a lower impact on overall quality. In addition, the measured projection data is reconstructed to generate original

image data. Also, the variance map may be displayed, analyzed, and processed based on the original image data.

The variance map so generated provides visual cues to the high noise regions in the reconstructed image. Additionally, the variance may also be used to provide for improved accuracy in computer aided detection and classification algorithms that utilize variance information. Furthermore, as described on page 10, paragraph [0033] of the present application, the present application teaches "an efficient approach for processing measured data and for generating variance data from measured projection image data."

On the contrary, Shih is drawn to a method and apparatus for producing a variance reconstruction of variations between an object and a standard. Particularly, Shih presents a method of rapid automated inspection of manufactured objects that involves *generating variance projections of the variations between the object and standard projections for particular perspectives* (see Shih Abstract). Specifically, the method of Shih entails acquiring an object projection of an object (see step 310 of FIG. 3), where the object projection is a projection of the object that is acquired with a specific perspective. Subsequently, a registration of the object projection is adjusted relative to the standard projection (see step 320 of FIG. 3).

Further, as disclosed in Shih, a variance projection is generated from the object and standard projections, where the *variance projection is representative of the difference between the object and standard projections* (see step 330 of FIG. 3). Applicants submit that as clearly evidenced by Shih, the variance projection includes an intensity map and positional data from the perspective that is common to the standard and object projections. For example, see Shih, paragraph [0035].

Clearly, generating **variance projections** of the **variations between the object and standard projections** for particular perspectives as taught by Shih fails to supply the claimed recitation of generating a **variance measure** based on **the measured projection data** of the present application. Furthermore, based on the cited passages and associated observations in the Office Action, Applicants respectfully note that the Examiner has apparently equated "generating variance projections of the variations between the object and standard projections" of Shih with the "generation of variance measure based on the measured projection data" as claimed in the

present application. Accordingly, Applicants respectfully reiterate that Shih **fails** to teach generation of variance measure based on the measured projection data as disclosed in the present application. In fact, as clearly evidenced at least by paragraph [0035] and claim 1 of Shih, *the variance projection represents the difference between the object and stored standard projections*. Particularly, any differences between the object and the stored standards create corresponding features in an intensity map (see Shih, paragraph [0035]). In sharp contrast, the *variance measure*, as described in the present application, is solely based on the object, computed on a pixel-by-pixel basis and refers to measures of variation within various regions of pixels (for example, see paragraph [0034] and FIG. 4).

In light of the above, Applicants assert that the disclosure of "generating variance projections of the variations between the object and standard projections" of Shih may not be scientifically and meaningfully equated with the "***generation of variance measure based on the measured projection data***" of the present application.

Further, in the Office Action, the Examiner conceded that Shih fails to teach or suggest or disclose generating a variance map from the variance measure. The Examiner relied upon Liang to obviate the deficiencies of Shih. Particularly, the Examiner argued that Liang teaches treating noise in low-dose CT projections and reconstructed images. The Examiner noted that the method includes generating a curve for variance and means given a set of raw data, fitting the curve by a functional form, and determining, for a fitted curve, a transformed space having substantially constant variance for all means. Furthermore, the Examiner noted that the method also includes applying a domain specific filter in a sinogram domain of the set of raw data, and applying an EPS filter in an image domain of the set of raw data after filtering in the sonogram domain (citing the Abstract and Figures 5 and 9). The Examiner further argued that it would have been obvious to one of ordinary skill in the art to combine the generating a variance map as taught by Liang with the measured projection data using a reconstruction method in order to reduce radiation and that useful images are formed from these measured projection data since on would be motivated to make such modification to reduce artifacts thus improving image quality.

Applicants respectfully note that based on the cited passages and associated observations in the Office Action, the Examiner is apparently equating "generating a curve for variances" of

Liang with the "*generating a variance map from the variance measure using a reconstruction algorithm*" as claimed in the current Application. Applicants respectfully disagree. Particularly, Applicants submit that Liang is drawn to a method for treating noise in low-dose computed tomography projections and reconstructed images. The method includes acquiring raw data at a low mA value, applying a domain specific filter in a sinogram domain of the raw data, and applying an edge preserving smoothing filter in an image domain of the raw data after filtering in the sinogram domain. To that end, Liang merely discloses generating a curve for variance and mean values given a set of raw data, fitting the curve by a functional form, and determining, for a fitted curve, a transformed space having substantially constant variance for all mean values. The method further includes applying a domain specific filter in a sinogram domain of the set of raw data, and applying an EPS filter in an image domain of the set of raw data after filtering in the sinogram domain. (*See* Abstract, Figure 5 and Figure 9 of Liang).

Applicants respectfully state that although Liang discusses *generating a curve for variance and means*, Liang fails to teach or suggest or disclose the cited claim element of *generating a variance map from the variance measure using a reconstruction algorithm.* Nowhere does Liang teach or suggest or disclose anything akin to *generating a variance map from the variance measure using a reconstruction algorithm* as disclosed in the present application. Moreover, Liang does not even mention the word "map" or anything analogous to that. Applicants respectfully emphasize that the claim element "variance map", as used in the present application, is very specifically described as a diagrammatical representation designed to visualize the regions of an image having similar variance due, for example, to one or more features or high density objects in the image (see page 10, paragraph [0034], lines 1-14). Therefore, Applicants assert that it may not be scientifically correct to equate a "variance map" as disclosed in the present application with a generic term such as a "curve for variances" as disclosed in Liang. Thus, Liang fails to supply the deficiencies of Shih.

For at least the reasons summarized hereinabove, Applicants submit that Shih and Liang, taken alone or in hypothetical combination, fail to disclose, teach or even suggest all elements of independent claims 12, 21, 28, 29 and 30. Hence, Shih even in combination with Liang fails to render claims 12, 21, 28, 29 and 30 obvious. Moreover, claims 13-20 are depend directly or indirectly from claim 12. Accordingly, Applicants submit that claims 13-20 are allowable by

virtue of their dependency from an allowable base claim, and for the subject matter they separately recite. Also, claims 22-27 depend directly or indirectly from claim 21. Accordingly, Applicants submit that claims 22-27 are allowable by virtue of their dependency from an allowable base claim, and for the subject matter they separately recite. Hence, it is respectfully requested that the rejection of claims 12-30 under 35 U.S.C. §103(a) be withdrawn.

CONCLUSION

For the reasons set out above, Applicants respectfully submits that the application is in condition for allowance. Favorable reconsideration and allowance of the application are, therefore, respectfully requested.

If the Examiner believes that anything further is necessary to place the application in better condition for allowance, the Examiner is kindly asked to contact Applicants' undersigned representative at the telephone number below.

Respectfully submitted,

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